Centre No.						Surname	Initial(s)
Candidate No.						Signature	

Paper Reference(s)

4335/2H

London Examinations IGCSE

Chemistry

Paper 2H

Higher Tier

Wednesday 16 May 2007 – Morning

Time: 2 hours

Examiner's use only

Team Leader's use only

Question Number	Leave Blank
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	
11	
Total	

Materials required for examination
Nil

Items included with question papers
Nil

Instructions to Candidates

In the boxes above, write your centre number and candidate number, your surname, initial(s) and signature.
The paper reference is shown at the top of this page. Check that you have the correct question paper.
Answer **ALL** the questions in the spaces provided in this question paper.
Show all the steps in any calculations and state the units.
Calculators may be used.

Information for Candidates

The total mark for this paper is 120. The marks for parts of questions are shown in round brackets: e.g. **(2)**.
There are 24 pages in this question paper. All blank pages are indicated.
A Periodic Table is given on page 2.

Advice to Candidates

Write your answers neatly and in good English.

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THE PERIODIC TABLE

Period	1	2											3	4	5	6	7	0
	Group																	
1	1 H Hydrogen 1																	4 He Helium 2
2	7 Li Lithium 3	9 Be Beryllium 4											11 B Boron 5	12 C Carbon 6	14 N Nitrogen 7	16 O Oxygen 8	19 F Fluorine 9	20 Ne Neon 10
3	23 Na Sodium 11	24 Mg Magnesium 12											27 Al Aluminium 13	28 Si Silicon 14	31 P Phosphorus 15	32 S Sulphur 16	35.5 Cl Chlorine 17	40 Ar Argon 18
4	39 K Potassium 19	40 Ca Calcium 20	45 Sc Scandium 21	48 Ti Titanium 22	51 V Vanadium 23	52 Cr Chromium 24	55 Mn Manganese 25	56 Fe Iron 26	59 Co Cobalt 27	59 Ni Nickel 28	63.5 Cu Copper 29	65 Zn Zinc 30	70 Ga Gallium 31	73 Ge Germanium 32	75 As Arsenic 33	79 Se Selenium 34	80 Br Bromine 35	84 Kr Krypton 36
5	86 Rb Rubidium 37	88 Sr Strontium 38	89 Y Yttrium 39	91 Zr Zirconium 40	93 Nb Niobium 41	96 Mo Molybdenum 42	99 Tc Technetium 43	101 Ru Ruthenium 44	103 Rh Rhodium 45	106 Pd Palladium 46	108 Ag Silver 47	112 Cd Cadmium 48	115 In Indium 49	119 Sn Tin 50	122 Sb Antimony 51	128 Te Tellurium 52	127 I Iodine 53	131 Xe Xenon 54
6	133 Cs Caesium 55	137 Ba Barium 56	139 La Lanthanum 57	179 Hf Hafnium 72	181 Ta Tantalum 73	184 W Tungsten 74	186 Re Rhenium 75	190 Os Osmium 76	192 Ir Indium 77	195 Pt Platinum 78	197 Au Gold 79	201 Hg Mercury 80	204 Tl Thallium 81	207 Pb Lead 82	209 Bi Bismuth 83	210 Po Polonium 84	210 At Astatine 85	222 Rn Radon 86
7	223 Fr Francium 87	226 Ra Radium 88	227 Ac Actinium 89															

Key

Relative atomic mass
Symbol
Name
Atomic number

Leave blank

SECTION A

1. Hydrogen peroxide decomposes into water and oxygen.

$$2H_2O_2 \rightarrow 2H_2O + O_2$$

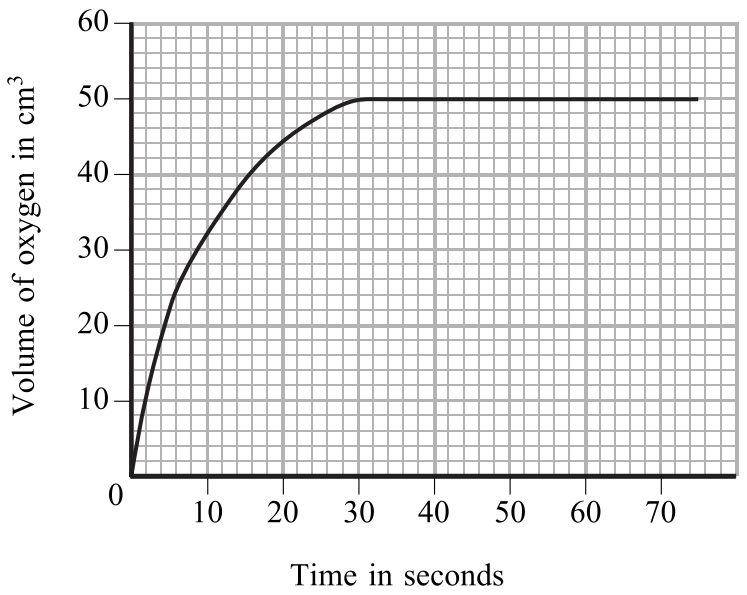
The reaction is very slow but becomes faster if manganese(IV) oxide is added. The manganese(IV) oxide does not get used up during the reaction.

(a) What is the role of the manganese(IV) oxide in this reaction?

.....

(1)

(b) The graph shows how the volume of oxygen collected changed with time when 1 g of small lumps of manganese(IV) oxide were added to 10 cm^3 of hydrogen peroxide.



Sketch on the axes above the results obtained when

(i) the experiment is repeated using 1 g of powdered manganese(IV) oxide.
Label this sketch **A**.

(2)

(ii) the same volume of hydrogen peroxide is used but 5 cm^3 of water is added to it before the manganese(IV) oxide is added.
Label this sketch **B**.

(2)

(c) Describe a test for oxygen gas.

Test .....

Result .....

(2) **Q1**

(Total 7 marks)

Leave blank

2. The decomposition of ammonium chloride is a reversible reaction.

$$NH_4Cl(s) \rightleftharpoons NH_3(g) + HCl(g)$$

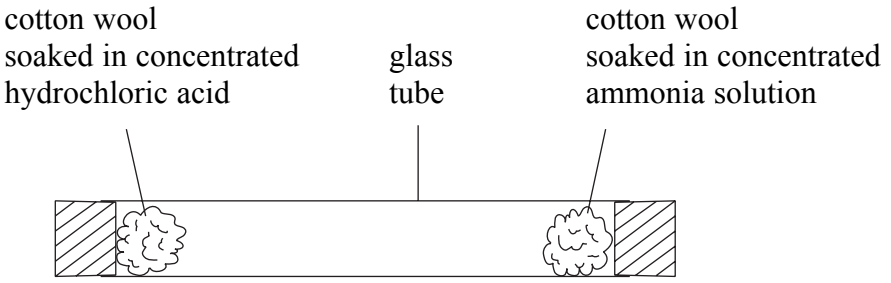
(a) How is this reaction made to go in the **forward** direction?

.....

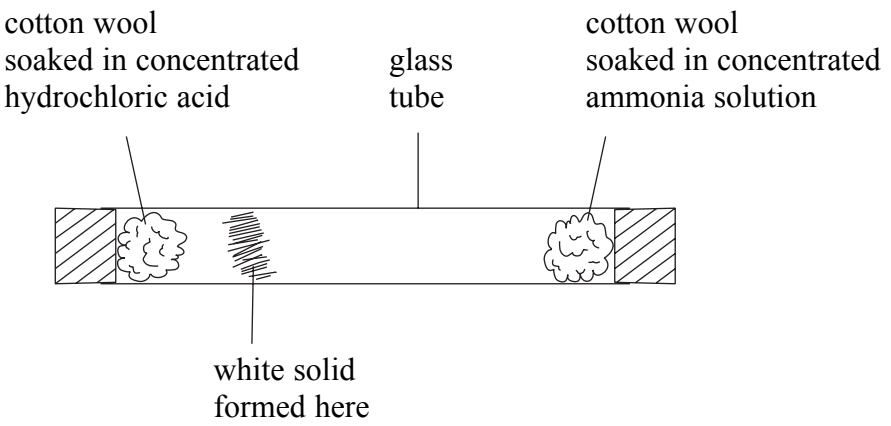
(1)

(b) Concentrated hydrochloric acid gives off hydrogen chloride gas.
Concentrated ammonia solution gives off ammonia gas.

An experiment is set up.



After a few minutes a white solid forms inside the tube. The solid forms when ammonia gas reacts with hydrogen chloride gas.



(i) Name the process by which the ammonia and hydrogen chloride particles move inside the tube.

.....

(1)

(ii) What is the white solid that forms inside the tube?

.....

(1)

Leave blank

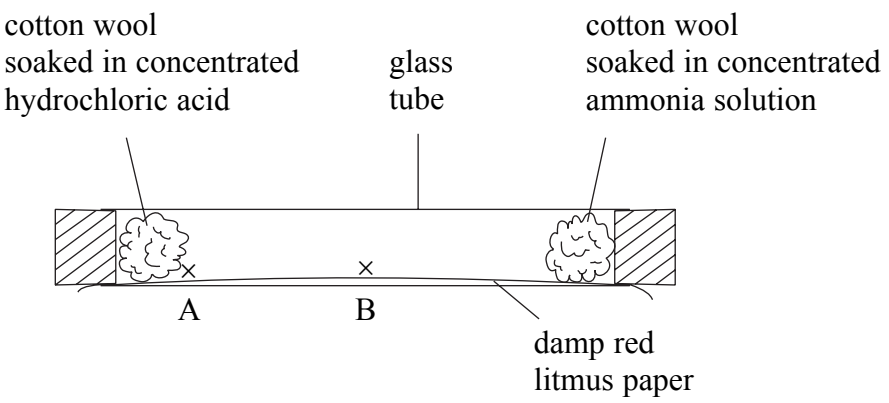
(iii) What does the position of the white solid tell you about the relative speeds at which the ammonia and hydrogen chloride particles move?

.....

.....

(1)

(iv) The experiment is repeated with a strip of damp red litmus paper placed along the inside of the tube.



State the colour of the litmus paper at A and B when the white solid forms.

A .....

B .....

(2)

(Total 6 marks)

Q2

Leave blank

3. The alkenes are a **homologous series** of **unsaturated** hydrocarbons.

(a) (i) Tick **two** boxes that are correct statements about members of an homologous series.

They have similar chemical properties ☐

They have the same displayed formula ☐

They have the same general formula ☐

They have the same physical properties ☐

They have the same relative formula masses ☐

(2)

(ii) What is meant by the term **unsaturated**?

.....

.....

(1)

(b) Alkenes react with bromine water. Ethene is the simplest alkene.

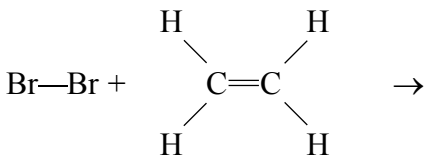
(i) Bromine water is added to ethene. State the starting and finishing colours of the reaction mixture.

Colour at start .....

Colour at finish .....

(2)

(ii) Complete the equation by drawing the displayed formula of the product.



(1)

Leave blank

(c) Isomers are compounds that have the same molecular formula but different displayed formulae.

Draw the displayed formulae of **two** isomers that have the molecular formula C_4H_8.

(2) **Q3**

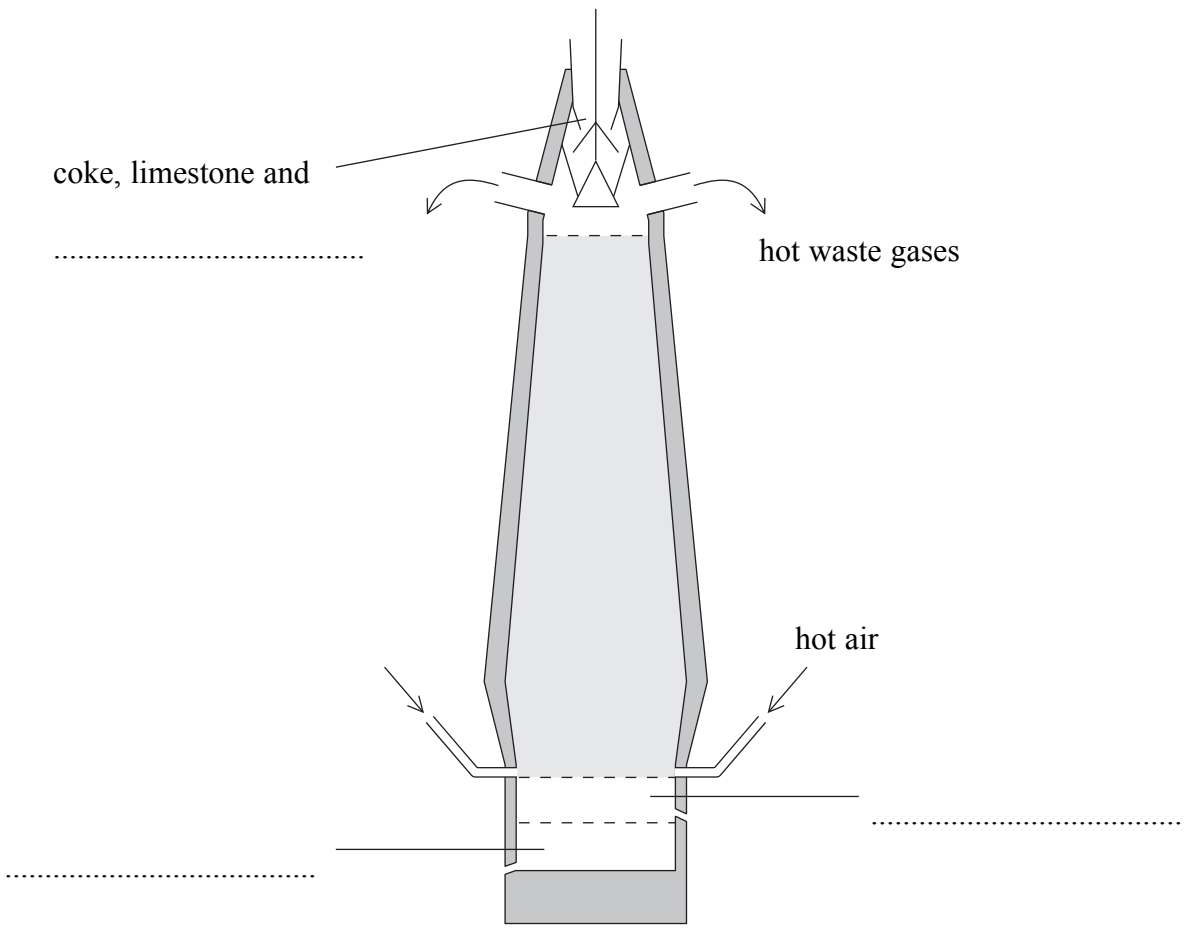
(Total 8 marks)

Leave blank

4. Iron is extracted from iron ore in a blast furnace.

(a) Label the diagram of the blast furnace. Use only words from the box. Each word may be used once, more than once or not at all.

bauxite	**cryolite**	**haematite**
molten iron	**sand**	**slag**



(3)

(b) Coke is mainly carbon which burns in the oxygen in the hot air.

(i) Write a chemical equation for the reaction.

.....

(1)

(ii) Why is this reaction important in the blast furnace?

.....

.....

(1)

Leave blank

(c) Limestone is mainly calcium carbonate. In the blast furnace it decomposes to give carbon dioxide and calcium oxide.

(i) Write a chemical equation for the reaction.

.....

(1)

(ii) Calcium oxide is a base. It removes silicon dioxide impurities. Explain how the calcium oxide removes the silicon dioxide.

.....

.....

.....

(2)

(d) Iron is produced by the reduction of iron(III) oxide. An equation for the reaction is

$$Fe_2O_3 + 3CO \rightarrow 2Fe + 3CO_2$$

Why is this reaction described as the reduction of iron(III) oxide?

.....

(1)

(e) Aluminium is another important metal.

(i) Unlike iron, aluminium cannot be extracted from its ore using a blast furnace. Explain why.

.....

(1)

(ii) State **one** large scale use of aluminium. Give a property of aluminium on which this use depends.

Use .....

Property .....

(2)

Q4

(Total 12 marks)

Leave blank

5. Sodium is a very reactive metal. It floats on water and reacts rapidly with water.

A small piece of sodium is placed in a trough of water. A reaction takes place and hydrogen gas is given off.

(a) (i) Give **two** observations, other than the sodium floating, that you could make during the reaction.

1 .....

2 .....

(2)

(ii) Write a word equation for the reaction.

.....

(1)

(iii) Universal indicator is added to the water in the trough. State what colour it turns and explain why.

Colour .....

Explanation .....

.....

.....

(2)

(b) A piece of platinum wire is dipped into the solution in the trough and then held in a roaring Bunsen flame. The Bunsen flame becomes coloured.

(i) What colour does the flame become?

.....

(1)

(ii) What name is given to this method of identification?

.....

(1)

Leave blank

(c) A piece of sodium is heated in a Bunsen flame. The sodium catches fire and reacts with the oxygen in the air. The product is sodium oxide.

(i) The diagrams show the electron arrangement in an atom of sodium and an atom of oxygen.

Sodium oxide contains ionic bonds. Describe what happens, in terms of electrons, when sodium reacts with oxygen.

.....

.....

.....

.....

.....

.....

(3)

(ii) Draw circles round the symbols that represent the two ions produced.

Na^+ Na^{2+} Na^- Na^{2-}

O^{2-} O_2^- O^- O^{2+}

(2) **Q5**

(Total 12 marks)

TOTAL FOR SECTION A: 45 MARKS

Leave blank

SECTION B

6. Many useful substances are produced by the fractional distillation of crude oil.

(a) Bitumen, fuel oil and gasoline are three fractions obtained from crude oil. There are several differences between these fractions.

Give the name of the fraction that has

the highest boiling point range .....

molecules with the fewest carbon atoms .....

the darkest colour .....

(3)

(b) Some long-chain hydrocarbons are converted into more useful products by a chemical process. Name this process and describe how it is carried out.

.....

.....

.....

.....

.....

.....

(3)

(c) Some hydrocarbons, such as methane, are used as fuels. When methane undergoes incomplete combustion, carbon monoxide is formed.

(i) Write a chemical equation for this reaction.

.....

(2)

(ii) Explain why it is dangerous to breathe air containing carbon monoxide.

.....

.....

.....

.....

(2)

Q6

(Total 10 marks)

Leave blank

7. Three of the elements in Group 7 of the Periodic Table are chlorine, bromine and iodine.

(a) Give the electronic configuration of chlorine.

.....

(1)

(b) How many electrons are there in the outer shell of an atom of iodine?

.....

(1)

(c) Bromine reacts with hydrogen to form hydrogen bromide. The chemical equation for the reaction is

$$Br_2(g) + H_2(g) \rightarrow 2HBr(g)$$

Describe the colour change occurring during the reaction.

Colour change .....

(2)

(d) Hydrogen bromide and hydrogen chloride have similar chemical properties.

(i) A sample of hydrogen bromide is dissolved in water.

A piece of blue litmus paper is placed in the solution. State, with a reason, the final colour of the litmus paper.

Colour .....

Reason .....

.....

(2)

(ii) A sample of hydrogen bromide is dissolved in methylbenzene.

A piece of blue litmus paper is placed in the solution. State, with a reason, the final colour of the litmus paper.

Colour .....

Reason .....

.....

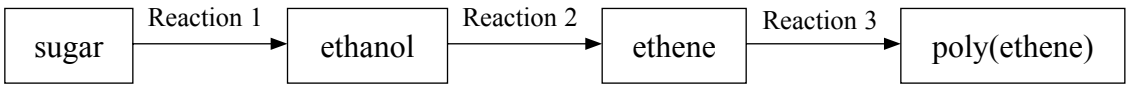
(2)

Q7

(Total 8 marks)

Leave blank

8. Sugar can be converted into poly(ethene) as follows:



(a) (i) State the type of reaction occurring in

Reaction 1 .....

Reaction 2 .....

(2)

(ii) What type of polymerisation occurs in Reaction 3?

.....

(1)

(b) State **two** conditions used in the conversion of sugar to ethanol in Reaction 1.

1 .....

2 .....

(2)

(c) Write a chemical equation for Reaction 2.

.....

(2)

(d) Draw the displayed formula of ethanol.

(1)

Leave blank

(e) Many thousands of ethene molecules combine to form a poly(ethene) molecule. Draw that part of the structure of a poly(ethene) molecule that forms from **three** ethene molecules.

(2)

(f) Nylon is made by a different type of polymerisation. Name this type of polymerisation and describe how it is different from the type of polymerisation used to make poly(ethene).

Type of polymerisation .....

Description .....

.....

.....

(2)

Q8

(Total 12 marks)

Leave blank

9. A sample of iron contains two isotopes.

(a) What are isotopes?

.....

.....

.....

(2)

(b) (i) Complete the table for the isotopes of iron.

Atomic number	Mass number	Number of protons	Number of neutrons	Percentage of each isotope in sample
		26	28	8
26	56			92

(3)

(ii) Use information from the table to calculate the relative atomic mass of the sample of iron. Give your answer to one decimal place.

.....

.....

.....

(2)

(c) Why do the two isotopes of iron have the same chemical properties?

.....

.....

(1)

(d) Iron is a transition metal. State **two** properties of iron that are typical of transition metals, but not of other metals.

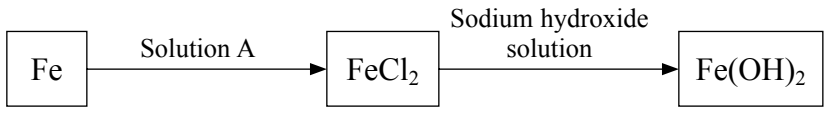
1 .....

2 .....

(2)

Leave blank

(e) Two reactions involving iron and its compounds are shown in this sequence:



(i) Give the name of

solution A .....

$Fe(OH)_2$ .....

(2)

(ii) Complete the chemical equation for the conversion of $FeCl_2$ to $Fe(OH)_2$.

$FeCl_2$ + ... ⟶ $Fe(OH)_2$ + ...

(2)

(iii) If $Fe(OH)_2$ is left in air for some time, a reaction occurs and there is a colour change. What type of reaction occurs and what colour change is seen?

Type of reaction .....

Colour change .....

(3)

Q9

(Total 17 marks)

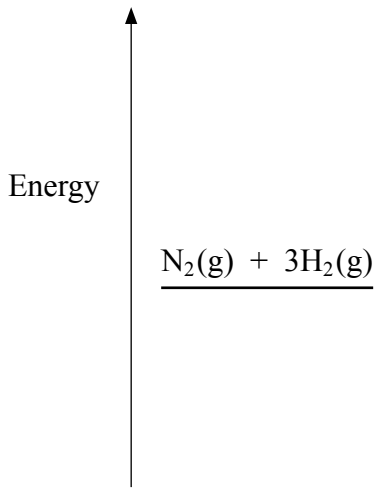
Leave blank

10. The reaction used to manufacture ammonia is

$$N_2(g) + 3H_2(g) \rightleftharpoons 2NH_3(g) \qquad \Delta H = -x \text{ kJ/mol}$$

(a) This reaction can be represented by an energy level diagram.

Complete the diagram by showing the products of the reaction.



(1)

(b) The table shows the values of some average bond dissociation energies.

Bond	N≡N	H–H	N–H
Dissociation energy (kJ/mol)	944	436	388

Use the values in the table to calculate the energy change occurring during the reaction to manufacture ammonia.

.....

.....

.....

.....

.....

(3)

Leave blank

(c) To obtain a reasonable yield of ammonia the reaction is carried out at a temperature of 450 °C and a pressure of 250 atmospheres.
Predict what will happen to the yield of ammonia in the equilibrium mixture if the conditions are changed as follows.

Temperature is increased .....

Pressure is decreased .....

(2)

(d) The temperature of a mixture of nitrogen, hydrogen and ammonia gases is decreased until all the gases have liquefied.

(i) Describe **two** changes in the movement of gas molecules as a gas liquefies.

1 .....

.....

2 .....

.....

(2)

(ii)

Molecule	N_2	H_2	NH_3
Heat of vaporisation (kJ/mol)	2.8	0.45	23

Use the values in the table to predict which of the three gases will be the last to liquefy.

.....

(1)

(e) Draw a dot and cross diagram to show the arrangement of **outer** electrons in a molecule of nitrogen.

(2) **Q10**

(Total 11 marks)

Leave blank

11. (a) A solution was made by dissolving 1.62 g of hydrogen bromide, HBr, in 250 cm^3 of water.

(i) Calculate the relative formula mass of hydrogen bromide. Use data from the Periodic Table on page 2.

.....

.....

(1)

(ii) Calculate the amount, in moles, of hydrogen bromide in a 1.62 g sample.

.....

.....

.....

.....

(2)

(iii) Calculate the concentration, in mol dm^{-3}, of the hydrogen bromide solution.

.....

.....

.....

.....

(2)

(iv) Calculate the concentration, in g dm^{-3}, of the hydrogen bromide solution.

.....

.....

.....

.....

(2)

Leave blank

(b) Hydrogen bromide solution can be neutralised by adding sodium hydroxide solution.
A 20.0 cm^3 sample of a solution of hydrogen bromide had a concentration of 0.200 mol dm^{-3}.

(i) Write a chemical equation for this neutralisation reaction.

.....

(1)

(ii) Explain, with reference to protons, why this reaction is described as a neutralisation reaction.

.....

.....

(2)

(iii) Calculate the amount, in moles, of hydrogen bromide in 20.0 cm^3 of 0.200 mol dm^{-3} solution.

.....

.....

(2)

(iv) Calculate the volume of 0.100 mol dm^{-3} sodium hydroxide solution needed to neutralise this sample of hydrogen bromide solution.

.....

.....

(2)

(v) Suggest the name of an indicator (other than litmus), and its colour change, that could be used to check when neutralisation was complete.

Name of indicator .....

Colour change .....

(3)

Q11

(Total 17 marks)

TOTAL FOR SECTION B: 75 MARKS

TOTAL FOR PAPER: 120 MARKS

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